SALINAS RIVER PROJECT, CUESTA TUNNEL
SOUTHEAST OF U.S. 101
SAN LUIS OBISPO VICINITY
SAN LUIS OBISPO COUNTY
CALIFORNIA

HAER No. CA-153-A

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40-SANLO.V,
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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
NATIONAL PARK SERVICE
WESTERN REGION
DEPARTMENT OF THE INTERIOR
SAN FRANCISCO, CALIFORNIA 94107

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HISTORIC AMERICAN ENGINEERING RECORD

SALINAS RIVER PROJECT,
CUESTA TUNNEL

HAER NO. ~~CA-145-A~~ CA-153-A

Location: San Luis Obispo County, California north of the city of San Luis Obispo at the Cuesta Grade. The north portal for the tunnel is about 1400 feet southeast of U. S. 101 at P. M. 5-SLO-101, P. M. 30.05. The south portal is 5327 feet (the length of the tunnel) to the southwest.

USGS San Luis Obispo Quadrangle 7.5'
UTM Coordinates: 10/714480/3915130 North portal
10/713650/3913700 South portal

Date of Construction: 1941-2

Engineer: Leeds, Hill, Barnard, and Jewett

Builder: L. E. Dixon Company

Present Owner: U. S. Government: Los Padres National Forest and U. S. Army Corps of Engineers, Los Angeles District

Present Occupant: County of San Luis Obispo, Flood Control District

Present Use: Water tunnel

Significance: The Cuesta Tunnel is important as an example of the heroic engineering and construction undertaken by the U. S. Army Quartermaster Corps in the early 1940s as part of the mobilization of American forces prior to World War II. The tunnel was constructed in less than 9 months from planning to use, an astonishing rate of construction given the length and diameter of the tunnel. While not unusually large or long in the general context of tunnels in California, the Cuesta Tunnel is an important example of the work of the Quartermaster Corps and private engineering and construction firms under mobilization conditions.

Report Prepared by:
Stephen D. Mikesell
JRP Historical Consulting Services
712 Fifth Street, Suite F
Davis, California 95616

Date: July, 1994

I. DESCRIPTION

The Cuesta Tunnel is a 5348 foot tunnel through the Santa Lucia Range in San Luis Obispo County. It is located north of the City of San Luis Obispo about midway between San Luis Obispo and Atascadero, at the crest of Cuesta Grade. The north portal (the intake) is at elevation 1334 feet about 1400 feet southwest of Highway 101 at post mile 5-SLO-101-P.M. 30.05. The tunnel has a grade of 6 feet to the mile. It is an elliptical arched tunnel opening, sometimes called a "horseshoe" tunnel, measuring nearly 6 feet at its widest and 9 feet at its high point.

The tunnel passes beneath the Santa Lucia mountains which separate the Salinas Valley from the coastal plains near San Luis Obispo. The depth below grade varies from grade at the two portals to about 850' roughly 3300' from the north portal. The tunnel includes two basic sections: lined and unlined, as shown in project plans, reproduced photographically as part of this HAER package. In both cases, the tunnel includes a concrete trough or floor and short concrete sides with channels, or construction keys, for original or future lining of the remainder of the tunnel opening. The lined sections include about 40 percent of the total tunnel length, with a lined section of about 450' at the south and a much longer section at the north, or about 2100' total. The tunnel was lined only where the rock was found to be unstable.[1] In these areas, the tunnel opening is supported on timber framing. The concrete trough and wall lining were poured inside the timbering. In the remaining 60 percent (about 3200'), the tunnel passes through very hard rock and was not lined completely. In these areas, the tunnel includes a concrete trough and construction key which form a wall height of about one foot but no timber framing or concrete on the rest of the side walls or roof.

The tunnel is hidden from public view except for the portals at the north and south. The portals themselves are also essentially hidden from the public view in that both are in areas of limited access. The north portal is close to U.S. 101 but is on a private lane to which public access has been denied by adjacent property owners. The south portal is accessible through Camp San Luis

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[1]As discussed under "Historical Information," the Cuesta Tunnel was built hastily during mobilization just before and after the attack on American forces at Pearl Harbor. The specifications for the tunnel work reflected the haste with which the project was undertaken. The Architect-Engineer contractor served both as the designer and construction engineer for the project. Specifications called for timber and concrete lining "whenever necessary," a condition which would be called out by the resident engineer during construction. Leeds, Hill, Barnard & Jewett, "Specifications for Driving, Timbering, and Concrete Lining of Cuesta Tunnel," Specification Serial No. 410829.2, 1941. Copy on file in Corps of Engineers, Los Angeles District, Design Section A. In a 1942 report, the designing engineer noted that "The tunnel will be lined with concrete through the bad formation where full timbering is required." Leeds, Hill, Barnard and Jewett, "Report to United States Engineer Office, Los Angeles, California on Analysis of Design of Salinas River Project."

Obispo and is at the top of a long, steep and winding dirt lane. Access is also available via Forest Service property (the access road starts at the top of Cuesta Grade - U. S. 101). A locked gate prevents vehicle access.

The portals are reinforced concrete boxes set into the adjacent hillsides at the north and south ends of the tunnel and are connected physically and operationally with the tunnel. The north portal is a concrete box measuring 8'3" wide, 13' deep and 9'5" high. The concrete walls are approximately 10" thick. The portal building is fitted into a tall rock outcropping. To the left, the building is joined to the rock by a 5' concrete wall, canted at about 45 degrees. At the right, the concrete box was built directly into the rock outcropping. At the top, the building is held to the rock by a vertical concrete wall about 4' high. Access to the tunnel at the north portal is gained through a rectangular opening that is 7'3" high and 5'6" wide. The opening is enclosed by metal doors and a metal plate. The plate extends 2'3" from the base, with side-hinged metal doors above it. Thus, to enter the tunnel, one must scale the bottom plate and enter through the opened doors. The metal doors and plates were designed to be removable, allowing an access opening to the tunnel nearly as large as the tunnel itself.[2]

Inside, the concrete box forms a chamber which regulates the flow of water before its enters the tunnel. The primary intake conduit is a 24" diameter concrete pipe buried as it enters the chamber, the water rising up from a rectangular opening at the base of the chamber. This water may surge within the chamber before flowing down the tunnel, which begins at the rear of the chamber. The portal also include two small metal pipes which carry water for specified users whose water sources were interrupted through construction of the tunnel.[3]

The south portal is similar to the north except for differences in topography and post-1942 modifications to it. It is a reinforced concrete box set into the hillside, creating a chamber for water before it enters the pipeline near Camp San Luis Obispo. It is slightly smaller than the north portal, being 7' deep, 8'8" high and 8'3" wide. Access to it is gained through a rectangular opening with the same dimensions as that on the north portal. At the south portal, however, much of the original opening has been in-filled with concrete, which covers the bottom plate and extends 2' above it. The metal plate and doors are still in place behind this concrete work. Because of this concrete work, it is necessary to scale a concrete wall of more than 4' to enter the tunnel at the south portal.

Inside, the chamber is essentially the reverse of the north portal, with water exiting through a rectangular opening at the floor of the chamber. The south portal has also been fitted with a

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[2]Leeds, Hill, Barnard and Jewett, "Report to United States Engineer," p. 18-6.

[3]Interview with Robert H. Born, April 15, 1994. Mr. Born was manager of the San Luis Obispo County Flood Control District, operator of the system.

small turnout pipe which can be used to maintain stream flows in the creek downstream, and to regulate air flows into and out of the tunnel in the event of breaks in water pressure. This air pressure regulator is a metal pipe connected to a small metal dam at the rear of the chamber (entrance to the tunnel). This pipe, installed in the mid-1960s[4], connects with a box of valves, located just outside the portal, and with valves at the crest of the hill about 100' from the portal. The chamber also includes depth and pressure gauges, mounted vertically at the entrance to the tunnel and connected by an electrical conduit to the outside of the portal. In addition, the south portal includes a visually intrusive but easily-removed set of weather gauges, mounted on tall sections of reinforced concrete pipe atop the portal.

The Cuesta Tunnel operates as part of a larger water delivery system, built by the U.S. Army during World War II and now used chiefly by the City of San Luis Obispo. Historically, the system was called the Salinas River Project. The system originates with the Salinas Dam, creating Salinas (sometimes called Santa Margarita) Reservoir on the Salinas River, due east of San Luis Obispo. This dam and all connecting pipelines were, like the Cuesta Tunnel, built for the Army in 1941-2. Water flows from the dam by gravity in 24" concrete pipes a distance of about 10 miles before it is pumped upwards an elevation of about 200'. Water is then channeled through the Cuesta Tunnel, exiting in an 18" concrete main pipe. The connecting route for the pipe south of the tunnel has been modified somewhat since 1942, with the bulk of the water flowing to reservoirs controlled by the City of San Luis Obispo rather than to Camp San Luis Obispo, the Army base for which the system was designed.

The Cuesta Tunnel is largely unaltered from its appearance in 1942. The only notable alterations are those to the south portal, discussed earlier. These affect only a tiny percentage of the original material in this structure. The north portal and the tunnel itself appear to be entirely unaltered.

II. HISTORICAL INFORMATION

Military and Civilian Water Supply History

Camp San Luis Obispo, like many Federal military installations in California, was extensively developed, not during American participation in World War II, but in a period of frenetic mobilization in the years just before the Japanese attack on American forces at Pearl Harbor. In May, 1940, as German forees were on the attack in France, Congress authorized an increase in

[4]Born interview.

American armed forces from about 200,000 to one and one-half million. Camp San Luis Obispo and dozens of other military posts throughout the United States had their origin in this massive pre-war mobilization.[5]

Camp San Luis Obispo was first activated as a National Guard training facility in 1928. Although it was the largest training facility for the Guard, this 5800 acre facility was used less than full time and had few permanent residents between 1928 and 1940. In 1940, this minor state-owned facility was taken over by the Federal government and activated as a regular Army camp, commissioned as an infantry division training center. With virtually no permanent residents prior to 1940, the camp was suddenly occupied by more than 20,000 soldiers, making it one of the largest training facilities on the West Coast and nearly as large as the City of San Luis Obispo.[6] The camp was expanded to more than 14,000 acres by the Army through a lease arrangement with the U. S. Forest Service, which controls much of the adjacent lands.

Prior to 1941, the camp's water needs were met by minor reservoirs connected to the water system of the City of San Luis Obispo. This system relied upon reservoirs west of the San Lucia Mountains which stored the waters of relatively small coastal streams. The volume of water in these streams was entirely inadequate, however, to serve the massive influx of military personnel.

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[5]This general pre-war mobilization is discussed in Maurice Matloff, *American Military History*. (Washington, D.C.: Office of the Chief of Military History, 1969), Chapter 19, "Between World Wars." The California situation is discussed in Roger W. Lotchin, *Fortress California, 1910-1961: from Warfare to Welfare* (New York: Oxford University Press, 1992). Pre-war mobilization in San Luis Obispo County is discussed in Stan Harth, Liz Kreiger and Dan Kreiger (eds)., *War Comes to the Middle Kingdom: California's Central Coast Enters World War II* (Sa Luis Obispo: EZ Nature Books, 1991).

[6]The history of Camp San Luis Obispo as a California National Guard facility is recorded in detail in the Biennial (later Quadrennial) Reports of the Adjutant General (now the Military Department), State of California, 1928 to present. Additional information about the camp is found in miscellaneous material in the library at the Citizen Soldier Museum, Sacramento. This history of Camp San Luis Obispo as a Federal facility is recorded in various sources. A succinct and accurate history is provided in Headquarters, Camp San Luis Obispo, "Camp San Luis Obispo: Home of the National Guard," n.d. See also Daniel E. Kreiger, *San Luis Obispo County: Looking Backward into the Middle Kingdom* Windsor Publications, 1988) and Stan Harth, Liz Kreiger and Dan Kreiger (eds)., *War Comes to the Middle Kingdom: California's Central Coast Enters World War II* (San Luis Obispo: EZ Nature Books, 1991); and Robert H. Born, "Salinas Dam -- A Remarkable Engineering Achievement," a paper in support of nomination of Salinas Dam as a significant Los Angeles Section and National Civil Engineering Landmark Project, American Society of Civil Engineers, November 10, 1993. There is some disagreement as to the population of Camp San Luis Obispo during World War II, ranging from 10,000 to 20,000. Kreiger estimates that 500,000 infantry soldiers were trained there during the course of the war.

In its original plans for Camp San Luis Obispo, the Army Quartermaster Corps contemplated a supplementary system which would store the water of Chorro Creek, a small stream which flows through the camp, supplemented by wells in and around Chorro Valley. Early tests on this stream revealed, however, that the supply would be insufficient to serve the intended personnel at the expanded base.

The idea for constructing the Salinas Dam and Cuesta Tunnel is generally credited to Raymond A. Hill of the firm of Leeds, Hill, Barnard, and Jewett, a civil engineering firm from Los Angeles which had been awarded the general engineering contract for laying out the Federal facility at Camp San Luis Obispo.[7] Leeds, Hill, Barnard and Jewett was an experienced engineering firm with an extensive background in dam and tunnel design. Mr. Hill suggested construction of a dam on the Salinas River, 15 miles of pipeline (including the one-mile Cuesta Tunnel), and miscellaneous filtration and delivery systems within the boundaries of Camp San Luis Obispo.[8]

In May, 1941, the City of San Luis Obispo and officials of Camp San Luis Obispo reached agreement on a joint effort to develop Salinas River water for the mutual benefit of the two parties.[9] The water storage project would involve three major components: a new dam on the Salinas River; a tunnel to divert water through the Santa Lucia Range; and miscellaneous water delivery lines to carry the water from the dam to the tunnel and from the tunnel to Camp San Luis Obispo and the city. The Army and the city jointly filed for water rights in May, 1941.[10] The project was estimated to cost $2.4 million, with the city responsible for about $1/2 million.

For the next year, the project was carried forth with the kind of heroic dispatch that was characteristic of military construction during the early 1940s. On May 21, 1941 -- a week after the water rights filings were made -- thc Quartermaster Corps at Camp San Luis Obispo supplemented its contract with Leeds, Hill, Barnard, and Jewett to design the tunnel as well as the dam and appurtenant facilities.[11] The construction contract for the tunnel was let as a

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[7]Born, "Salinas Dam -- A Remarkable Engineering Achievement," 1993, p. 2.

[8]Born, 1993, p. 4. Mr. Born based his history of this large facility upon inspection of original reports and personal interviews with Mr. Hill in 1956. The history of the early design work is also detailed in Leeds, Hill, Barnard and Jewett, "Report to United States Engineer," 1942.

[9]San Luis Obispo *Telegraph-Tribune,* May 13, 1941, p. 1.

[10]San Luis Obispo *Telegraph-Tribune*, May 14, 1941, p. 1.

[11]The entire Salinas River Project was designed by Leeds, Hill, Barnard and Jewett and constructed by L. E. Dixon. The work was originally undertaken in a modification of their respective contracts with the Quartermaster Corps. On January, 1942, the Corps of Engineers took over responsibility for constructing Camp San Luis Obispo and all other Army bases then under

supplement to the general construction contract for Camp San Luis Obispo; the general contractor was L. E. Dixon, the supplement dated May 23, 1941.[12] Captain J. A. Fraps of the Quartermaster Corps represented the Army during the tunnel construction; K. L. Parker was the supervising engineer for L. E. Dixon; W. C. Christopher represented Leeds, Hill, Barnard, and Jewett.[13]

Tunnel excavation began in June, 1941 and continued through March, 1942. Crews were assembled at each portal, about 40 men at each end, working in round-the-clock shifts, every day during that period except Labor Day, Christmas, and New Year's Day.[14] The two crews met on January 2, 1942. Remaining tasks, including building the portals and lining the canal, were completed by late March. Thus, the entire task was completed in about 9 months, an enviable accomplishment for a hard rock tunnel.[15]

As noted, the tunnel was built as part of the larger Salinas River Project, which included the Salinas Dam and distribution works to the camp and City of San Luis Obispo. The entire project began with contracts to the Quartermaster Corps but was completed under the general supervision of the Army Corps of Engineers, Los Angeles District, which assumed control over all aspects of base construction at Camp San Luis Obispo on January 1, 1942. Following completion of the tunnel, operation of the full system -- dam, tunnel, distribution works -- was transferred to the Quartermaster Corps as part of its overall responsibility for operating and maintaining the base.

Camp San Luis Obispo continued to serve as a regular Army base through the end of World War II but was returned to the California National Guard in 1947.[16] The Federal government again leased the property in 1951, during the Korean conflict, and maintained control through 1965,

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construction. Corps of Engineers, Los Angeles District, "Report on Salinas Dam," June 15, 1943.

[12]Corps of Engineers, Los Angeles District, "Report on Salinas Dam," June 15, 1943.

[13]M. Neff Smart, "Men Race Against Time to Build Salinas Dam: The River God Is Writhing," San Luis Obispo *Telegram-Tribune*, September 20, 1941, p. 3; Leeds, Hill, Barnard and Jewett, "Report to United States Engineer," April 1, 1942.

[14]San Luis Obispo *Telegram-Tribune* January 2, 1942, 1:2-3.

[15]According to press reports, the work generally progressed at a rate of 30 feet per day, which compares favorably with other well-known tunneling jobs. The great Ward Tunnel in the Big Creek Project, for example, discussed below under "Technological History," did not average 30 feet per day, although the construction conditions were probably much more difficult.

[16]The post-World War II history of the camp is summarized in the California Military Department, Quadrennial Report, 1987-1990, p. 114.

when it was finally returned to the California National Guard. Camp San Luis Obispo has served as a National Guard training camp since that date, although its relative importance has declined in comparison with Camp Roberts, a World War II era Army base which straddles the Monterey-San Luis Obispo county line and which is now the California National Guard's principal training facility. Since 1965, about 1000 acres of the original Camp San Luis Obispo land has been transferred to other agencies or private individuals and parts of the Camp San Luis Obispo lands have been taken over by other State of California agencies, including the departments of Transportation and Corrections.

The water system -- Salinas Dam, the Cuesta Tunnel, and downstream water distribution system -- was transferred from the regular Army to the Army Corps of Engineers in 1947 and was operated by the Corps until the Federal Army camp was dismantled in 1965. The entire system was leased in 1965 to the Flood Control District of the County of San Luis Obispo, which operates the system chiefly to supply water to the City of San Luis Obispo.[17]

From the outset, the Cuesta Tunnel and related works have served both civilian and military uses. With the closure of Camp San Luis Obispo as an Army base, that use became predominantly civilian. The tunnel today supplies most of the drinking water used by the City of San Luis Obispo.

Technological History

The Cuesta Tunnel may be seen as representing an important aspect of tunnel design, an aspect which may be appreciated in the context of tunnel construction in California and the general history of tunneling.

Tunneling represents a major and important chapter in the civil engineering and construction history of California. Tunnels are used for a variety of purposes in California but four functions dominate: the delivery of drinking water (as with the Cuesta Tunnel); the delivery of water to hydroelectric power generators; transportation purposes, both railroad and highways; and sewers. For various historical and topographical reasons, Californians have built some of the most remarkable tunnels in the world. Beginning with the Gold Rush of the mid-19th century, California businessmen and public policy makers attempted to serve a burgeoning population with great water, power, and transportation needs. These needs could be met only through heroic

[17]Interview with Glenn Priddy, Flood Control District of the County of San Luis Obispo, April 6, 1994. The ownership of the tunnel is somewhat complicated in that the underlying land title has always resided with the U.S. Forest Service; the tunnel is located entirely within the boundaries of the Los Padres National Forest. The U.S. Army acquired an easement to construct the original tunnel. That easement was transferred to the U.S. Army Corps of Engineers, which now leases it to the County of San Luis Obispo.

construction within a diverse and generally difficult terrain. This bold period of construction included the building of vast systems of railroads, highways, hydroelectric power plants, and aqueducts, all of which required tunnels. The Cuesta Tunnel, while not one of the most notable examples, falls within the general context of daring tunnel construction in California. The valorous nature of the Cuesta Tunnel has less to do with its length or diameter than with the great speed with which it was constructed and the wartime conditions which made expediency so important.

Tunneling is an ancient art. Water and transportation tunnels date to Greek construction in the sixth century B.C. and probably somewhat earlier.[18] Tunneling methods were linked historically to the mining industry, particularly with respect to hard rock tunnels. The essential prerequisites for efficient hard rock tunneling include: a method for surveying underground alignments; tools for boring into rocks; explosives for crushing the rocks; methods for removing debris (mucking); and ventilation techniques. All of these techniques were first developed in the hard rock mining industry but adapted to the special requirements for transportation, water, and sewage tunnels. Among the key developments, first associated with mining but adapted to tunneling are: compressed air and hydraulic drilling machines (first introduced in the mid-19th century) as substitutes for manual drilling; nitroglycerine and later dynamite as substitutes for gunpowder in the blasting operation; and various methods for framing long mining shafts and tunnels, developed in ancient times but greatly improved in the mines of the American Far West. All of these mining-related improvements are traceable to the mid- and late-19th century. The use of concrete as a tunnel liner, a important development of the very late 19th century, came not from mining but from the technological advances in the general construction trades.[19]

Tunneling in California began in a general sense began with the hard rock mining industry, where many of the aforementioned improvements were either developed or first tested on a grand scale. Strictly-defined tunnels, however, were not built in great numbers in California during the late 19th century. The most impressive tunnels from this period were those built for railroads in the Sierra Nevada, Cascades, and coastal ranges.

The most active period of water tunnel construction in California came in the early to mid-20th century, construction that was a associated with the hydroelectric power industry, municipal water development, and, to a lesser degree, with irrigation works.

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[18]The most useful general historical overview of tunnel construction history is Graham West, *Innovation and the Rise of the Tunneling Industry* (New York: Cambridge University Press, 1988).

[19]These improvements are discussed at length in West and in C.A. Pequignot, *Tunnels and Tunneling*. (London: Hutchinson Scientific and Technical, 1963). West and Pequignot summarize other tunneling improvements made in the mid-20th century, such as rotary tunnel boring machines, none of which were utilized in building the Cuesta Tunnel.

Hydropower provided a great impetus for water tunnel construction in California. California hydropower plants, as well as plants in other Western states, were unusual from the national perspective because they relied upon very high head (the distance water is dropped) and relatively low volume. These plants took advantage of the topography of the Sierra Nevada, in which most substantial California rivers originate, to compensate for the absence of great flows.[20] The great hydroelectric systems of the Sierra Nevada required some of the most spectacular water tunnels ever built. For example, the Ward Tunnel on the Big Creek system, built by a predecessor of the Southern California Edison Company in 1920-5, is a 15' diameter bore and is 67620' (or nearly 13 miles) long.[21] The Big Creek tunnels were unusually long but hydroelectric tunnels of five miles or more were not uncommon in the Sierra Nevada in the early part of the century. While differing one from the other, hydroelectric tunnels were generally comparable to the bore of the Cuesta Tunnel, between 9' and 14' in diameter.[22] The method of construction was also similar, with timber framing behind the concrete liner in unstable soils and either lined or unlined sections through hard rock; most commonly, hydropower tunnels were lined, even in the very hard rock of the Sierra Nevada.

A second group of great water tunnels was built by the cities of San Francisco and Los Angeles, mostly during the 1920s and 1930s, during construction of the massive Hetch Hetchy and Los Angeles Aqueduct systems. These tunnels were generally of a much larger diameter than hydroelectric tunnels; the Hetch Hetchy tunnel through the Coast Range mountains is 18' in diameter, while the Los Angeles tunnels are about the same. Some of these municipal water tunnels were also extraordinarily long. The most spectacular tunnel associated with a municipal water system in California is the Coast Range Tunnel built by the City of San Francisco in the late 1920s. It includes a 25-mile continuous tunnel, the longest tunnel in the world when it was completed.[23] Construction began on the Los Angeles Aqueduct in the first decade of the 20th

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[20]The most comprehensive discussion of early California hydropower plants and associated tunnels is found in Frederick Hall Fowler, "Hydroelectric Power Systems of California," U.S. Geological Survey, Water-Supply Paper No. 493, 1923. The most convenient survey of the history of hydropower development is Norman A.F. Smith, *Man and Water: A History of Hydro-Technology* (London: P. Davies, 1976).

[21]David H. Redinger, *The Story of Big Creek.* (Los Angeles, Eureka Press, 1949) p. 133.

[22]H.K. Barrows, *Water Power Engineering* (New York: McGraw-Hill Book Company, 1934), 340-50.

[23]San Francisco Water & Power, *A History of the Municipal Water Department and Hetch Hetchy System.* (San Francisco: City of San Francisco, 1985) p. 37.

century, long before similar work was undertaken on the Hetch Hetchy system. The Los Angeles Aqueduct featured many enormous tunnels, including the Elizabeth Tunnel, completed in 1911, which is nearly five miles long.[24]

Massive water tunnels were built at mid-century by the state and Federal agencies which constructed the modern multiple-purpose aqueducts which today are the backbone of the California water delivery system, including the Colorado River system and Central Valley Project of the U.S. Bureau of Reclamation and the State Water Project of the California Division of Water Resources. The bulk of this construction occurred after World War II and therefore after completion of the Cuesta Tunnel.

The Cuesta Tunnel is important within a very specific context in the history of tunnel construction in California. By most technical measures -- priority of construction, diameter, length, and so forth -- it is not among the leading tunnels in California. The technological importance of an engineering feature goes beyond these technical measures. In discussing a National Historic Landmarks study of tunnels, for example, Robie Lange specifically eschews reliance upon these technical measures, noting, "The tendency to focus on tunnels which are credited with being the longest or deepest will be avoided. Such properties often merely reflect the extreme application of existing construction methods. These claims also lead to confusion when a longer or deeper tunnel eclipses the earlier record holder."[25] Neither does the Cuesta Tunnel appear to be significant in terms of the use of innovative tunneling techniques, which are the focus of the NHL study.

The importance of the Cuesta Tunnel is in its direct association with the pre-war mobilization effort and because it is an excellent example of the cooperative work of the Quartermaster Corps and private contractors during that period. The tunnel stands as a monument to the frenetic development of Camp San Luis Obispo and the "can do" engineering associated with the pre-war mobilization. At a mile in length and 9' x 6' in section, the Cuesta Tunnel is certainly not an insignificant example of tunnel construction. The remarkable fact about it is that it was built in less than 9 months from start to finish, including most of the project planning and contract negotiation time. No known secondary sources rate California tunnels by this measure -- span of time between planning and completion -- but the Cuesta Tunnel surely ranks among the highest, particularly those with lengths of a mile or more. Whatever its ranking, the Cuesta Tunnel also stands as a testimony to the remarkable dedication of the Quartermaster Corps in the years just prior to World War II, during which it heroically prepared hundreds of new military bases throughout the United States and abroad in preparation for war. Other California buildings

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[24]William L. Kahrl, *Water and Power: the Conflict over Los Angeles' Water Supply in the Owens Valley* (Berkeley: University of California Press, 1982), p. 162.

[25]Robie Lange, "Landmarks in Civil Engineering," *CRM* Vol. 15, No. 8, 1992, p. 14.

and structures survive, of course, in testimony to the work of the Quartermaster Corps, although the Cuesta Tunnel is highly unusual, if not unique, as an example of the Quartermaster Corps work in water development, an area of construction typically undertaken by the Army Corps of Engineers.

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Telephone interview with Robert H. Born, April 15, 1994. Born was manager of the Flood Control District of the County of San Luis Obispo.

Telephone interview with Charles H. Huntting, May 19, 1994. Mr. Huntting was a surveyor with Leeds, Hill, Barnard & Jewett and worked on the tunnel construction.

Personal interview with Glenn Priddy, Flood Control District of the County of San Luis Obispo, April 6, 1994.

Telephone interview with Al Switzer, May 4, 1994. Mr. Switzer worked for the Corps of Engineers in 1942 and was involved with early design work on the tunnel and dam.

Photographic Collections

There is an unfortunate paucity of historic photographs of the construction of the Cuesta Tunnel. Research was conducted in a wide variety of archives but no historical photographs of the tunnel were located.

Four major archives were inspected: the San Luis Obispo County Museum in San Luis Obispo; the archives of the Corps of Engineers, Los Angeles District; the National Archives in Washington, D.C.; and the archives of the California National Guard in San Luis Obispo County and Sacramento.

The San Luis Obispo County Museum possesses an extensive collection of construction photographs (File 87-88) of Camp San Luis Obispo, including many photographs of the construction of the Salinas Dam as well as the filtration plants for the water system within the Camp San Luis Obispo boundaries. This collection, however, does not include views of the tunnel.

A detailed search was made of the files of the Corps of Engineers, Los Angeles District. These files include various completion reports, project reports, specifications, and plans for the Salinas River Project, including completion reports for the Cuesta Tunncl. While historic photographs were included for the dam, no historic photographs were included for the Cuesta Tunnel.

Federal Record Center and Archives were searched, first in Southern California and subsequently in Washington, DC and Maryland. A telephone contact was made with the Federal Records Center in Laguna Niguel; helpful staff confirmed that the center retains no records pertaining to the Cuesta Tunnel.

At the National Archives in Washington, D.C. and Maryland, searches were made of the records of the Quartermaster Corps (RG 92), Corps of Engineers (RG 69), and the Works Progress Administration (RG 69). The Corps of Engineers records appear to duplicate those found at the Los Angeles District, including the completion reports for the dam and tunnel, along with construction photographs of the dam, but no photographs of the tunnel.

With respect to the California National Guard, contracts were made at two locations: at the engineering office at Camp San Luis Obispo and at the Citizen Soldiers Museum, a historical museum for the California National Guard in Sacramento. No historic photographs were located at either source.

Finally, telephone calls were made to various individuals who were involved with construction of the tunnel, including Al Switzer and Charles Huntting, listed under "interviews," to attempt to locate privately-held photographs of the tunnel under construction. No photographs were located through this means.

IV. PROJECT INFORMATION

This documentation has been prepared at the request of the California Department of Water Resources (DWR), which is proposing to modify the Cuesta Tunnel to provide additional water deliveries to the central coast cities as part of its Coastal Branch of the State Water Project. The Coastal Branch project generally seeks to divert water from the State Water Project California Aqueduct in Kern County, carry that water in pipe over the coastal range, and deliver water to cities south of San Luis Obispo, including Santa Barbara. The project will use the Cuesta Tunnel as a means of carrying its pipes through the Santa Lucia Range. The DWR project will affect most of the tunnel. The two portals will be demolished to accommodate new, larger intakes. The rebuilt tunnel will include four new pipes which will be embedded in concrete. The four pipes include two 6" diameter PVC pipes for communication conduits, a 24" for the Nacimiento Pipeline, and a new 42" diameter pipe for the Coastal Branch water. The four pipes will be set in concrete, with an open channel reserved for existing flows above the new concrete enclosures. In addition, the unlined portions of the tunnel, which comprise more than half the total length, will be lined in at least two inches of shotcrete.